



SCANDIUM-46

HANDLING PRECAUTIONS

^{46}Sc
 83.83 d
 β^- 0.357
 γ 0.889
 1.121
 E 0.357

PHYSICAL DATA

Principal Radiation Emissions⁽¹⁾
 Maximum Beta Energy: 0.357 MeV (100%)
 Gammas: 1.121 MeV (100%)
 0.889 MeV (100%)
 Maximum Range of Beta in Air: 84 cm (33 in.)⁽²⁾
 Unshielded Exposure Rate at 1 cm from a 1 mCi Point Source: 10.8 R/h⁽³⁾.
 Unshielded Exposure Rate at 1 m from a 1 MBq Point Source: 7.6 nC/kg/h⁽³⁾.
 Half-Value Layer for Lead Shielding: 8 mm (0.33 in.)⁽³⁾

DOSIMETRY

Gamma emissions from ^{46}Sc present an external exposure hazard. Beta emissions from ^{46}Sc contamination on skin can contribute a shallow dose which can be prevented by wearing gloves. It may be assumed that 40%, 30% and 10% of uptakes of ^{46}Sc are transferred to the skeleton, liver and spleen respectively, and 20% uniformly distributed throughout all other organs and tissues of the body⁽³⁾. 10% and 90% of all ^{46}Sc in the body may be assumed to be retained with biological half-lives of 5 and 1500 days respectively⁽⁵⁾.

OCCUPATIONAL LIMITS⁽⁴⁾

Annual Limit on Intake: 900 μCi (33 MBq) for oral ingestion and 200 μCi (7 MBq) for inhalation.
 Derived Air Concentration: $1 \times 10^{-7} \mu\text{Ci/mL}$ (3.7 kBq/m³).

DECAY TABLE

Physical Half-Life: 83.83 Days⁽¹⁾

To use the decay table, find the number of days in the top and left hand columns of the chart then find the corresponding decay factor.
 To obtain a precalibration number, divide by the decay factor. For a postcalibration number, multiply by the decay factor.

		Days									
		0	1	2	3	4	5	6	7	8	9
Days	0	1.000	0.992	0.984	0.976	0.968	0.960	0.952	0.944	0.936	0.928
	10	0.921	0.913	0.906	0.898	0.891	0.883	0.876	0.869	0.862	0.855
	20	0.848	0.841	0.834	0.827	0.820	0.813	0.807	0.800	0.793	0.787
	30	0.780	0.774	0.768	0.761	0.755	0.749	0.743	0.736	0.730	0.724
	40	0.718	0.712	0.707	0.701	0.695	0.689	0.684	0.678	0.672	0.667
	50	0.661	0.656	0.651	0.645	0.640	0.635	0.629	0.624	0.619	0.614
	60	0.609	0.604	0.599	0.594	0.589	0.584	0.579	0.575	0.570	0.565
	70	0.561	0.556	0.551	0.547	0.542	0.538	0.533	0.529	0.525	0.520
	80	0.516	0.512	0.508	0.503	0.499	0.495	0.491	0.487	0.483	0.479

GENERAL HANDLING

PRECAUTIONS FOR SCANDIUM-46

1. Designate area for handling ^{46}Sc and clearly label all containers.
2. Store ^{46}Sc behind thick lead shields.
3. Wear extremity and whole body dosimeters while handling mCi (37 MBq) quantities.
4. Use shielding to minimize exposure while handling ^{46}Sc .
5. Do not work over open containers.
6. Use tools to indirectly handle unshielded sources and potentially contaminated vessels.
7. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{46}Sc is handled.
8. Use transfer pipettes, spill trays and absorbent coverings to confine contamination.
9. Handle ^{46}Sc compounds that are potentially volatile or in powder form in ventilated enclosures.
10. Sample exhausted effluent and room air by continuously drawing a known volume through a membrane filter.
11. Wear disposable lab coat, gloves and wrist guards for secondary protection.
12. Select gloves appropriate for chemicals handled.
13. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
14. Use pancake or end-window Geiger-Mueller detector, NaI(Tl) or liquid scintillation counter to detect ^{46}Sc .
15. Submit urine samples for bioassay at least four hours after handling ^{46}Sc to indicate uptake.
16. Isolate waste in clearly labeled shielded container and hold for decay.
17. Establish air concentration, surface contamination and bioassay action levels below regulatory limits. Investigate and correct any conditions that may cause these levels to be exceeded.
18. On completing an operation, secure all ^{46}Sc ; remove and dispose of protective clothing and coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

REFERENCES

1. Kocher, David C., Radioactive Decay Data Tables, Springfield: National Technical Information Service, 1981 DOE/TIC-11026.
2. Kaplan, Irving, Nuclear Physics, New York: Addison-Wesley, 1964.
3. Calculated with computer code "Gamma" utilizing decay scheme data from Kocher(1) and mass attenuation coefficient for lead and mass energy absorption coefficients for air from the Radiological Health Handbook, Washington: Bureau of Radiological Health, 1970. The HVL reported here is the initial HVL for narrow beam geometry.
4. U.S. Nuclear Regulatory Commission. 10CFR 20 Appendix B – Standards for Protection Against Radiation, 1994.
5. ICRP Publication 30, Part 3, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford, 1981.

